CLAIMS

What is claimed is:

1. A magnetic current loop system adapted to produce strong near fields and weak far fields, the magnetic current loop system comprising:

(a) first and second magnetic current loops being divided into *k* sections, *k* being an integer, each of the *k* sections having a series reactance at a frequency;

(b) k reactive compensation elements, each reactive compensation element being coupled to one of the *k* sections and having a reactance that substantially cancels the series reactance of each section at the frequency; and

(c) a current source coupled to the first and second magnetic current loops such that current flows in a first direction in the first magnetic current loop and in a second direction, opposite the first direction, in the second magnetic current loop thereby substantially canceling a dipole field at a distance spaced from the first and second magnetic current loops.

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2. The magnetic current loop system of claim 1 wherein the series reactance of each of the *k* sections comprises an inductive reactance and each of the *k* reactive compensation elements comprises a capacitor.

3. The magnetic current loop system of claim 2 wherein each capacitor has a capacitance value C_k such that $\frac{1}{\omega C_k}=\omega L_k$, wherein ω is the

angular frequency of the current source and L_k is the series inductance of the k^{th} section of the magnetic current loops.

4. The magnetic current loop system of claim 1 wherein the *k* sections are substantially equal in length and the series reactances of the *k* sections are substantially equal.

5. The magnetic current loop system of claim 1 wherein at least some of the *k* sections are unequal in length and some of the series reactances of the *k* sections are not equal.

6. The magnetic current loop system of claim 1 wherein the current source is adapted to produce a current having a frequency of about 13.56 MHz.

7. The magnetic current loop system of claim 1 wherein the first magnetic current loop is located in a first plane and the second magnetic current loop is located in a second plane spaced from and parallel to the first plane.

8. The magnetic current loop system of claim 1 wherein each of the first and second magnetic current loops includes *n* turns, *n* being an integer.

9. The magnetic current loop system of claim 8 wherein *n* is equal to one.

10. The magnetic current loop system of claim 8 wherein n is greater than one.

11. The magnetic current loop system of claim 1 wherein the first and second magnetic current loops are coaxial with each other.

12. The magnetic current loop system of claim 11 wherein sections of the first magnetic current loop are substantially equal in length to adjacent sections of the second magnetic current loop.

13. The magnetic current loop system of claim 12 wherein the reactive compensation elements associated with sections of the first magnetic current loop are substantially equal in reactance to reactive compensation elements of the adjacent sections of the second magnetic current loop.

14. A reader for a magnetic-current-loop-based communication system, the reader comprising:

(a) first and second magnetic current loops, each being divided into n sections, n being an integer, each section having a series reactance;

(b) $2n$ reactive compensation elements, one element being associated with each of the $2n$ sections, such that the reactive

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compensation elements substantially cancel the series reactance of each of the sections; and

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~~(c) circuitry operatively associated with the first and second~~ magnetic current loops for communicating with a device when the device is within a predetermined distance of the first and second magnetic current loops.

15. The reader of claim 14 wherein the first and second magnetic current loops are coaxial with each other.

16. The reader of claim 15 wherein the first and second magnetic current loops are connected to each other so that current flows in a first direction through the first magnetic current loop and in a second direction, opposite the first direction, through the second magnetic current loop.

17. The reader of claim 15 comprising:

(a) a third magnetic current loop positioned between and equidistant from the first and second magnetic current loops for coupling to a magnetic field from the device; and

(b) circuitry operatively associated with the third magnetic current loop for processing a signal modulated on the magnetic field from the device.

18. The reader of claim 17 comprising a microprocessor operatively associated with the circuitry for performing a predetermined function in response to the signal from the device.

19. The reader of claim 18 wherein the microprocessor is adapted to perform an authentication function in response to the signal from the device.

20. The reader of claim 18 wherein the microprocessor is adapted to store at least some of the information contained in the signal from the device in a memory device.

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21. A magnetic current loop system comprising:

(a) a magnetic current loop being divided into *n* sections, n being an integer, each of the *n* sections having a series reactance at a frequency; and

(b) *n* reactive compensation elements respectively coupled to each of the *n* sections, each of the *n* reactive compensation elements having a reactance that substantially cancels the series reactance of the corresponding section at the frequency, thereby producing substantial current magnitude and phase uniformity along the magnetic current loop.

22. The system of claim 21 wherein the series reactance of each of the *n* sections comprises an inductive reactance and the reactance of each

of the respective compensation elements comprises a capacitive reactance.

23. The system of claim 21 wherein each of the *n* sections includes a series resistance, a series inductance, a shunt capacitance, and a shunt resistance, the shunt capacitance and the shunt resistance of each section having a first time constant, and wherein each of the reactive compensation elements has a reactance value such that the series resistance and an effective capacitive series reactance of each of the sections has a second time constant that is substantially equal to the first time constant.

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24. A magnetic current loop system comprising:

(a) *n* magnetic current loops, *n* being an integer, each of the *n* magnetic current loops being divided into sections, each section having a series reactance; and

(b) reactive compensation elements respectively coupled to the sections, each of the reactive compensation elements having a reactance that substantially cancels the series reactance of the respective section.

25. The system of claim 24 wherein *n* is equal to one.

26. The system of claim 24 wherein *n* is greater than one.

27. The system of claim 24 wherein the *n* magnetic current loops comprise first, second, and third magnetic current loops being coaxial with each other, the third magnetic current loop being located between the first and second magnetic current loops.

28. The system of claim 27 comprising a first current source coupled to the first and second magnetic current loops adapted to produce a first current having a first magnitude and a first direction in the first and second magnetic current loops and a second current source coupled to the third magnetic current loop adapted to produce a second current having a second magnitude and a second direction in the third magnetic current loop, the second direction being opposite the first direction and the second magnitude being twice the first magnitude.

29. The system of claim 24 wherein the *n* magnetic current loops comprise first and second pairs of magnetic current loops being coaxial with each other.

30. The system of claim 29 wherein the first and second pairs of magnitude current loops each include an inner magnetic current loop and an outer magnetic current loop, and the inner magnetic current loops of each pair are adjacent to each other.

31. The system of claim 30 comprising a current source coupled to the outer magnetic current loop of each pair such that current flows in a

first direction in the outer magnetic current loop of each pair and to the inner magnetic current loop of each pair such that the current flows in a second direction opposite the first direction in the inner magnetic current loop of each pair.

32. The system of claim 26 comprising a current source coupled to each of the magnetic current loops such that current flows in the same direction in all of the magnetic current loops.

33. A method for reactively compensating magnetic current loops, the method comprising:

(a) dividing first and second magnetic current loops into *k* sections, *k* being an integer, each of the *k* sections having a series reactance at a frequency;

(b) adding reactive compensation to each of the *k* sections such that the reactive compensation substantially cancels the series reactance of each of the *k* ~~sections;~~

(c) driving the magnetic current loops with a current source having a frequency such that current flows in a first direction in the first magnetic current loop and in a second direction in the second magnetic current loop; and

(d) placing the first and second magnetic current loops in close proximity to each other to substantially cancel dipole fields produced by the magnetic current loops.

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34. The method of claim 33 wherein the series reactance of each of the k sections is a series inductive reactance and adding reactive compensation to each of the k sections includes adding a capacitor to each of the k sections.

35. The method of claim 33 wherein dividing the first and second magnetic current loops into k sections includes dividing the first and second magnetic current loops into k sections having substantially equal lengths such that the series reactances of the k sections are substantially equal.

36. The method of claim 33 wherein dividing the first and second magnetic current loops into k sections includes dividing the first and second magnetic current loops into k sections, at least some of which are unequal in length, such that the series reactances of at least some of the k sections are not equal.

37. The method of claim 33 wherein driving the magnetic current loops with the current source comprises driving the magnetic current loops with the current source having the frequency substantially centered about 13.56 MHz.

38. A method for reactively compensating a magnetic current loop, the method comprising:

~~(a) dividing the magnetic current loop into *k* sections, *k* being an~~ integer, each of the *k* sections having a series reactance at a frequency; and

(b) adding reactive compensation to each of the *k* sections such that the reactive compensation substantially cancels the series reactance of each of the *k* sections at the frequency, thereby making the amplitude and phase of a current in the loop at the frequency substantially uniform throughout the loop and thereby providing more precise control over generation of a magnetic field at the frequency.